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STRATA CONTROL INVESTIGATIONS IN THE SYDNEY COALFIELD
Annual Report, January 1 to December 31, 1984

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by

T.R.C. Aston*, P. Cain*, W.D. Gallant** and L.S. O'Leary**

SUMMARY

This report reviews the work undertaken by the Strata Mechanics group of the Cape Breton Coal Research Laboratory (CBCRL) for the period January 1 to December 31, 1984. It provides a brief description of the research activities undertaken in the Lingan, No. 26 and Donkin-Morien mines as well as the results obtained and the current status of other ongoing research programmes currently being undertaken in the Sydney Coalfield.

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INVESTIGATIONS PORTANT SUR LE CONTRÔLE DES STRATES À LA HOUILLÈRE DE SYDNEY

Rapport annuel du 1er janvier au 31 décembre 1984

par

T.R.C. Aston*, P. Cain*, W.D. Gallant** et L.S. O'Leary**

SOMMAIRE

Le présent rapport porte sur les travaux effectués par le Groupe de travail sur la mécanique des strates du Laboratoire de recherche sur le charbon du Cap-Breton (LRCCB) dans la période allant du 1er janvier au 31 décembre 1984. On donne une brève description des activités de recherche entreprises aux mines Lingan, N° 26 et Donkin-Morien et des résultats obtenus. Le rapport traite également de la situation actuelle des autres programmes de recherche présentement en cours à la houillère de Sydney.

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INTRODUCTION

During the period January 1 to December 31, 1984, the Strata Mechanics group of the Cape Breton Coal Research Laboratory (CBCRL) has undertaken a variety of work at the Cape Breton Development Corporation (CBDC) Lingan, No. 26 and Donkin-Morien mines. No work was undertaken at Prince Mine during this period. The annual report is intended to provide a brief description of activities undertaken (both ongoing research programmes and contract work), the results obtained and the status of ongoing projects.

CBCRL - STRATA MECHANICS RESEARCH ACTIVITY

Six main strata mechanics research programmes are currently in progress at CBCRL:

1. Gateroad Deformation and Gob Leakage
2. Barrier Pillar Design Criteria
3. Outburst Research
4. Evaluation of Undersea Subsidence Criteria
5. Rock/Support Interaction Studies in TBM Driveages
6. Instrumentation - Development/Testing

GATEROAD DEFORMATION AND GOB LEAKAGE

Gateroad deformation studies have been carried out in conjunction with a research programme to analyse the problem of gob leakage in the advancing longwall panels at Lingan Colliery, (1). The objective was to trace gob leakage paths and quantities, although an attempt to evaluate the effectiveness of actual and potential remedial measures was also envisaged. In March 1984, a research contract was completed which undertook a detailed review of gateroad sealants to reduce gob leakage in advancing longwall sections in the Sydney Coalfield, (2).

Two gateroad deformation monitoring sites were installed in the Lingan 8E panel coal road, Figure 1, in order to provide data for the evaluation of design criteria. A detailed description of the instrumentation can

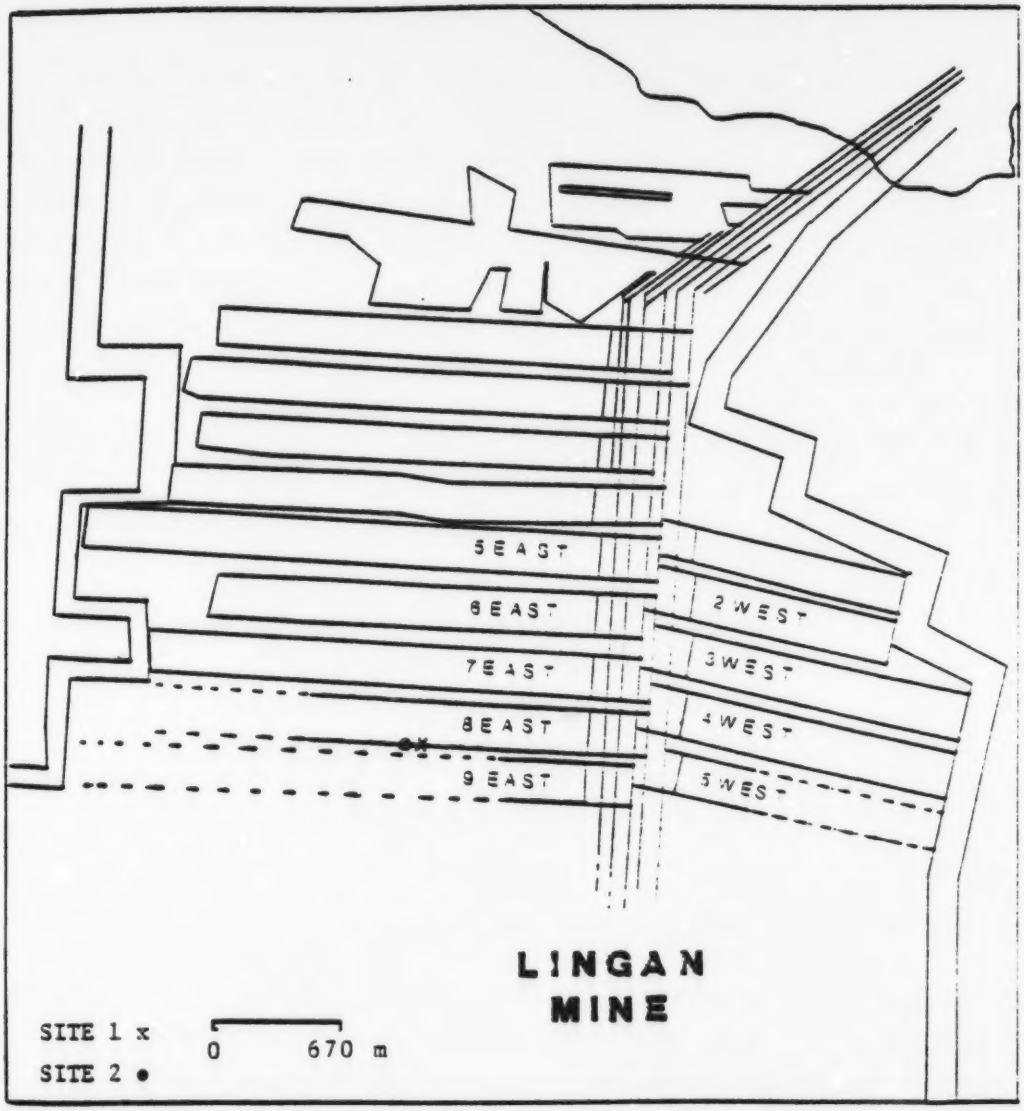


Figure 1 - Location of gateroad deformation monitoring sites, 8 East coal road, Lingan Mine

be found elsewhere (3), (11), but a plan of the installation used at both sites is given in Figure 2.

The results from both sites are very similar and show that major deformation and pack loading is almost complete after 60 m of face advance. At this point, the pack load on the 1.5 m x 1.5 m chock is 4.5 MN/m^2 (660 psi). Closure within the gateroad was found to be 28 cm on the ribside and 48 cm on the packside. After 60 m the pack load remained steady while the gateroad closure continued at a time dependent rate of 2% of the original arch height per 100 metres of advance.

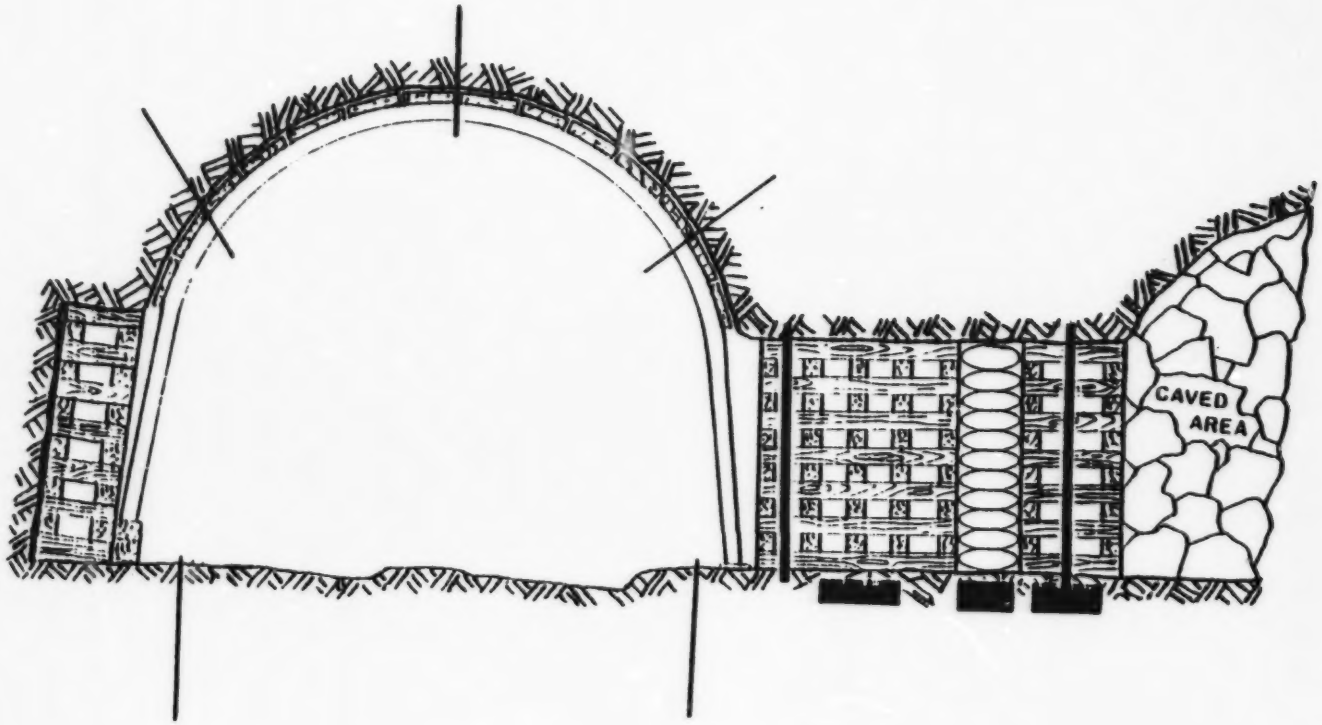
The monitoring of pack load at both sites indicates that a support resistance of between 6.5 and 8.5 MN/m of roadway is required to maintain good conditions. Future modifications to the pack design should therefore aim to equal this support level in order to maintain adequate gateroad conditions.

Finally, results obtained from extensive gateroad deformation surveys undertaken at Lingan Mine (4) were also used in evaluating the geotechnical and ventilation data collected.

BARRIER PILLAR DESIGN CRITERIA

The use of advancing longwall methods has lead to the practice of leaving rib pillars between panels in order to maintain gateroad deformations within acceptable limits. The width of these pillars results in sterilization of between 30 and 40% of coal reserves and increases the amount of non-productive development required. Accurate rib pillar design criteria are necessary to reduce unnecessary sterilization and non-productive development due to overdesign and establish the technical framework in which rib pillar elimination can be considered.

To assist in the development of suitable design criteria, an extensive gateroad deformation survey was undertaken in over 35 km of accessible gateroad at the Lingan and No. 26 mines (4). Analysis and presentation of preliminary results from the Lingan surveys has already been undertaken, (5). In addition, data from both the Lingan and No. 26 mines is currently being analysed by members of the McGill University Mining Department under an EMR University Research Agreement.



0 0.88 m

Flat Jack

Pack Strut

Roof Bolt

Figure 2 - Equipment installation plan, 8 East coal road monitoring sites, Lingan Mine.

Analysis of the Lingan survey data, (5), allowed the preparation of a design curve relating the average expected gateroad closure to the rib pillar width over a pillar range of 30 m to 90 m.

Additional work is currently in progress to produce design curves for different depths and to allow the use of calculated convergence as a guide to the estimation of support requirements.

OUTBURST RESEARCH

Since 1977, thirty-seven events identified as outbursts have occurred in the No. 26 Colliery workings below a depth of 700 m. In general, the early events were described as roof falls because of their docile nature and because no methane emission was recorded. However, the two most recent events in November 1983 and January 1984 were particularly violent and resulted in the temporary halt of further 'main deeps' development until a method of control could be implimented. The November 1983 occurrence demolished 18 arches, ejected 300 m^3 of rock and over 750 m^3 of methane. The January 1984 occurrence demolished 16 arches, ejected over 150 m^3 of rock and almost 3200 m^3 of methane.

The ejected material consisted of pulverised fine/medium grained sandstone. The outbursts only occurred where the overlying sandstone unit came within 2.7 m of the top of the coal and the development roadway was being driven using 'drill and blast' methods.

Porosity and permeability measurements on the ejected sandstone material could not account for the quantity of gas released and the concept of an elevated gas pressure in the sandstone horizon was therefore developed. An instrumentation programme was initiated to monitor the elevated in situ sandstone gas pressure, but only achieved limited success. In addition, a series of in situ stress determination measurements were made in close proximity to the outburst area using the USBM overcoring technique.

The closure of No. 26 Colliery in April 1984 due to a serious fire resulted in the loss of the outburst area at which further field investigation programmes were planned. However, outburst research is continuing and involves both modelling studies and the application of hydrofracturing technology for the de-stressing of strata in outburst prone zones from within the coal mine workings. A case history paper is in preparation and will be

presented at the 21st International Safety in Mines Research Institute Meeting in Sydney, Australia, October 1985.

In Situ Strata Gas Pressure Monitoring

In order to monitor in situ gas pressures, a borehole was drilled in strata close to the outburst prone area and a 'packer' arrangement installed. The 'packer' was obtained from Roctest of Montreal and consisted of a Model VLP 22/40, designed to fit in a 75 mm diameter borehole. Essentially, the packer consists of two inflatable rubber glands 1 m long separated by a 1 m length of perforated steel tubing. The glands were inflated using nitrogen and the whole system regulated from a control box located in the roadway at the base of the borehole.

The 'packer' was installed a minimum of three tunnel diameters from the side of the roadway in order to locate it in undisturbed ground. The final 'packer' location was between 18.82 and 19.46 m at a sandstone horizon exhibiting discing. Installation occurred immediately after the completion of drilling and removal of the drill rig from the base of the hole. Once installed, the glands were inflated to 7.93 MPa (1150 psi) and the cavity left to equalise with the in situ strata pressure. After five days the pressure in the glands had decreased to 7.72 MPa (1120 psi), at which level it remained for the duration of the test programme, although no discernable pressure increase had occurred in the test cavity.

A decision was therefore made to pressurize the test cavity with nitrogen in order to stimulate gas flow from the surrounding strata. Nitrogen was injected into the cavity until a pressure of 3.45 MPa (500 psi) was reached. After eight days, pressure in the cavity had decreased to 2.62 MPa (380 psi) where it remained for a further seven days. Fifteen days after initial pressurization, the cavity pressure increased to 2.76 MPa (400 psi) over a 48-hour period and remained steady at this level for the rest of the test period (45 days). A full description and discussion of the in situ strata gas pressure monitoring at No. 26 Colliery is currently being prepared (6).

Finally, because of the potential errors associated with the No. 26 Colliery instrumentation and results, it is uncertain whether the pressure of 2.8 MPa accurately reflects the true in situ strata pressure in the sandstone. It is therefore intended to undertake further analysis of the results

in order to infer the actual in situ strata gas pressure.

In Situ Stress Determination

In December 1983, a programme of in situ stress determination was undertaken by Golder Associates at No. 26 Colliery in an area close to the outburst prone zone, (7). Measurements were undertaken in three 100 mm diameter boreholes located close to the end of the 'main deeps', approximately 300 m from the boundary of the current mining area.

A total of nine overcoring tests were attempted of which only five were completely successful. The test data was used to evaluate: (a) the secondary principal stresses (for individual tests) on a plane perpendicular to the drillhole axis for the case of plane strain, and (b) the average stress tensor in the rock strata by applying the method of least squares.

The results of the least squares solution indicate that there is good correlation between independent measurements carried out in the three separate drillholes.

The state of in situ stress in the rock strata tested is fairly isotropic with very low shear stresses. The major principal stress is 26.30 MPa and oriented in the EW direction at an inclination of 25 degress. The ratio of the major and minor principal stresses is about 1.1. The average vertical stress component measured at the test site is about 15 percent higher than the static vertical stress.

Hydrofracturing Research

During the intense period of outburst research activity undertaken in early 1984, the potential application of hydrofracturing techniques for the de-stressing of outburst prone zones was identified. A research contract was initiated and let to undertake a detailed review and evaluation of hydrofracturing techniques for the prevention of rock/gas outbursts in underground Canadian coal mines.

Essentially, the objectives of the contract can be summarized as follows:

i) Briefly summarize the concepts of hydrofracturing.

ii) Review and evaluate the application of hydrofracturing techniques to the de-gassing and de-stressing of strata in underground coal mines.

iii) Review and evaluate the available hydrofracturing technology available for de-gassing and de-stressing coal and/or coal measures strata from within the workings of an underground coal mine.

iv) Consider the various advantages and disadvantages of the technology discussed in section iii.

v) Identify areas in hydrofracturing theory, practice and technology that with suitable research and development could find application to the underground de-gassing and de-stressing of coal and/or coal measures strata.

vi) Propose a programme of research and development that would lead to the demonstration and potential commercialization of hydrofracturing techniques for the de-gassing and de-stressing of coal and coal measures strata.

vii) Consideration should be given to the complete design process required to succcessfully initiate fracturing (estimation of the strata potential for fracturing, fracture treatment design, etc.).

viii) Review current Canadian coal mining needs for the use of underground hydrofracturing for the de-gassing and/or de-stressing of coal measures strata.

ix) Identify future industry needs.

Completion of the contract is expected in March 1985.

Determination of Triaxial Properties of Outburst Prone Strata

Preliminary research into the No. 26 outburst occurrences revealed that major factors influencing their appearance was the stress regime around the mine opening and the strata behaviour in this region, which is essentially dynamic. A research contract was initiated and let to address the behaviour of strata under dynamic stress regimes, including the development of suitable testing procedures.

The objectives of the contract can be summarized as follows:

i) Design, develop and calibrate a test method for determining the following parameters:

- peak and residual stress envelopes for rock samples subjected to decreasing confinement in a triaxial cell until failure occurs and then subjected to increasing axial stress.

- the effects on the above of the rate of unloading and loading.
- the effects on the two items above of increased gas pore pressures in the specimen.

Special consideration should be given to optimizing the number of specimens required, and the techniques should be calibrated against traditional triaxial testing methods using a range of 'reference' materials.

If the preliminary report is acceptable, the contractor will be required to conduct the same suite of tests on materials from No. 26 Colliery or other places in the Sydney Coalfield. Completion of the contract is expected in March 1985.

EVALUATION OF UNDERSEA SUBSIDENCE CRITERIA

The applicability of existing North American and European undersea subsidence guidelines to the Sydney Coalfield is uncertain because they have been applied without due regard for changes in regional/local mining conditions and geology. In addition, they were derived from land truthed data which has subsequently been extrapolated to undersea conditions rather than empirically derived from seabed truthed data, (8).

A long term research programme has therefore been established at CBCRL to evaluate existing undersea subsidence criteria and their applicability to the Sydney Coalfield. The programme can be separated into three distinct yet interrelated components:

1) Evaluation of existing subsidence criteria to the Sydney Coalfield.
2) Effective sealing of offshore exploration boreholes.
3) Determination of in situ permeability changes between the mining horizon and seabed.

Evaluation of Existing Subsidence Criteria to the Sydney Coalfield

At present, the major thrusts of the project lie in two research contracts let by CBCRL.

The first, (9), which has just been completed involved a review and evaluation of potential data collection methods for monitoring subsidence over longwall workings in submarine coalfields. Initially, the report outlines environmental conditions which may be expected in the offshore portion of the Sydney Coalfield. A detailed review of ground movement phenomena, land based subsidence instrumentation and design criteria for seabed subsidence monitoring is then made along with the variety of direct monitoring

instrumentation available. A detailed discussion is undertaken of the positioning and surveying techniques required as well as the potential monitoring systems available; Sea Surface, Subsea and Geophysical. Finally, the marine application of direct monitoring equipment and the requirements of the recommended system are discussed along with the presentation of preliminary cost estimates.

A detailed description of the various systems available is considered beyond the scope of this work and can be found in the contract report, (9). However, the system identified as having most potential involves the installation of suitable data collection instrumentation packages at the bedrock/sediment interface which are either 'stripped' periodically or transmit data to a central processing unit for subsequent transmission to a land based receiving station.

The second contract was let in the autumn of 1984 to undertake a literature review and evaluation of computer based subsidence prediction techniques and assess their applicability to underground Canadian coal mining.

The objectives of the contract can be summarized as follows:

i) Identify, review and evaluate all the available analytical/numerical modelling techniques which have been used for subsidence prediction.

ii) Consideration should be given to techniques which can incorporate amongst other things: strata/geological conditions, multiple seam mining and two/three dimensional representation.

iii) Consider the advantages and disadvantages associated with each technique.

iv) Rank the various techniques for application to submarine subsidence prediction and research purposes.

v) Identify and review potential analytical/numerical modelling techniques which to date have not been applied to subsidence research but which might find application with suitable research and development. These techniques must also be ranked in conjunction with those identified in section iv) and consideration should also be given to the possible combination of existing and as yet unapplied approaches.

vi) Catalogue all computer programmes encountered during the course of the review (Title, Method, Language, Owner, Deficiencies, Strengths Sensitivities, etc.).

Completion of the contract is expected in March 1985.

Finally in addition to contract research, an in-house review and evaluation of the applicability of the National Coal Board Subsidence Engineers Handbook (10) for the prediction of subsidence in the Sydney Coalfield is currently being undertaken.

Effective Sealing of Offshore Exploration Boreholes

Currently, exploration boreholes both offshore and in zones of major water bearing aquifers are backfilled, usually with cement. However, considerable uncertainty exists concerning the effectiveness of the resulting seal, especially if the borehole zone were to be undermined. A large pillar is therefore left surrounding the borehole which sterilizes a portion of the resource block and complicates the final mine design. Alternatively, the mine can be conceptually designed first and then the optimum position for the boreholes determined, although a large pillar is still left around each borehole.

A conflict therefore exists between the need for accurate geological information at the mining horizon (i.e. boreholes) and the ultimate resource recovery implications of borehole safety pillars. The development of a highly effective sealing technique would allow either the coal pillar to be significantly reduced or completely mined and the conflict resolved.

A research contract has been let to undertake a review and evaluation of existing, emerging and potential exploration borehole sealing technology for application to areas of coal mining in offshore and major aquifer bearing zones.

The objectives of the contract can be summarized as follows:

i) Review current technology for sealing offshore exploration boreholes and/or those boreholes penetrating major aquifer horizons.

ii) Evaluate and rank the effectiveness of current techniques giving their respective advantages and/or disadvantages.

iii) Identify possible modifications to existing techniques which could result in more effective borehole sealing.

iv) Identify, evaluate and rank emerging and potential techniques or technology from other disciplines which could, with suitable research and development, be used to develop a highly effective sealing technique.

v) Summarize existing borehole sealing regulations used in Canadian coal mining operations.

vi) Review current and future coal industry needs regarding the sealing of exploration boreholes.

vii) Determine the frequency by which existing boreholes have resulted in changes to mine plans.

viii) Compare current Canadian sealing regulations/practices with those in selected foreign jurisdictions.

ix) Discuss the risk associated with longwall mining through offshore or major aquifer intersecting boreholes and outline possible methodologies to reduce such risk to levels that would be acceptable to industry and regulatory officials.

Completion of the contract is expected by March 1985.

ROCK/SUPPORT INTERACTION STUDIES IN TBM DRIVEAGES

The initial phase of the Donkin-Morien project involves the development of two tunnels (Nos. 2 and 3) 3.5 km in length to intersect the Harbour seam. Eventually, the Donkin-Morien mine is planned to have an annual production (ROM) in the region of four million tons per year.

At present the No. 3 tunnel has advanced a total distance of 1027 m at a decline of 20% for the first 780 m and 10% for the final 247 m using drill and blast methods. A 7.6 m diameter full face tunnel boring machine (TBM) manufactured by Lovat of Toronto is being used to drive the No. 2 tunnel. The No. 2 tunnel inclination is 20% for the first 790 m, then an 80 m curve followed by a 10% decline for 100 m, then another 100 m curve to bring it to its final alignment of 1.075%. The distance between the tunnel No. 2 and 3 centres is 50 m. A research programme is currently being undertaken by the Cape Breton Coal Research Laboratory (CBCRL) - CANMET, CBDC and Golder Associates to monitor the rock/support interaction of the TBM and Drill and Blast driveages.

ROCK/SUPPORT INTERACTION PROGRAMME

The rock/support interaction programme involves the extensive installation of instrumentation to monitor strata movement and support response in both the No. 2 and No. 3 tunnels.

In the No. 2 tunnel the programme calls for the installation of three comprehensive instrumentation arrays, one in each of the three major geological units encountered within the tunnel (sandstone, siltstone and mudstone). Each of these arrays involves:

1) Installation of three extensometers from within the head of the TBM (one vertically up and two near horizontal on either side of the machine).
2) Installation of a downhole extensomenter immediately behind the machine.
3) Installation of strain gauges and load cells on the circular steel sets to measure strain development and both axial and circumferential load.
4) Installation of strain gauges on the thrust blocks. Unlike other types of TBM, the Lovat machine does not thrust off the side walls of the tunnel, but instead uses a series of rams to push off the tunnel support system.
5) Installation of convergence points on both the steel sets and the tunnel side walls.

Additional instrumentation in the No. 2 tunnel includes the installation of mini arrays either within or behind the TBM (vertically up and/or springline extensometers) located in areas of weak ground - coal, seatearth, mudstone or red beds.

In the No. 3 tunnel the following instrumentation sites have been installed and monitored:

1) Installation of 4 extensometers (up, down and both sides) at chainage 1025 m.
2) Installation of extensometers in two near horizontal boreholes crossing the pillar between the No. 3 and No. 2 tunnels.

3) In situ stress determinations in the massive sandstone unit, using both USBM and CSIRO techniques.
4) Installation of convergence points at various intervals during the tunnel driveage.

Finally, a geotechnical testing programme is being undertaken on core samples from both tunnels to provide rock property data on the various strata types encountered. Detailed hammer seismic and borehole dilatometer surveys will also be undertaken in order to provide in situ rock moduli for both tunnels.

Project Status

To date, all three major arrays have been installed in the No. 2 tunnel:

Chainage 925 m - Sandstone Unit (April '84)
Chainage 1045 m - Siltstone Unit (May '84)
Chainage 1850 m - Mudstone Unit (July '84)

Each of the major arrays comprises the following instrumentation:

1) Extensometer installed in the TBM head.
2) Extensometer installed behind the TBM.
3) Strain Gauges/Load Cells installed on the steel sets.
4) Strain Gauges installed on the thrust blocks.

In addition, monitoring of the No. 3 tunnel cross boreholes and the in situ stress determination work has been completed. In early November, dilatometer and hammer seismic studies to determine in situ rock moduli will be undertaken in both the No. 2 and No. 3 tunnels.

Finally, it is expected that the installation and monitoring of 'mini' arrays will be completed early in 1985, with the final report becoming available around June/July 1985. A preliminary report containing some of the initial results has already been presented, (10).

INSTRUMENTATION - DEVELOPMENT/TESTING

CBCRL is currently developing or testing three pieces of instrumentation suitable for use in underground strata mechanics programmes:

1) COR-P/R Convergence Meter
2) Gob Load Cell
3) Ultrasonic Closure Meter

COR-P/R Convergence Meter

A full description of the COR-P/R Convergence Meter is given elsewhere, (11). Initial trials have proven successful and a modification is now being considered to allow the device to measure convergence over a greater range. Currently, the inclusion of a second telescopic unit in the strut body is the only method of increasing the physical range of the instrumentation and a transducer which operates independently of the closure mechanism is therefore required.

The adopted principle involves the mounting of a 0-35 kPa pressure transducer at the base of the instrument to measure the changes in hydraulic head of an oil filled tube attached to the top of the strut. Investigations regarding the sensitivity of this approach are currently in progress with field trials, if successful, scheduled for the first half of 1985.

Gob Load Cell

A comprehensive understanding of strata behaviour around longwall panels has been hindered by a lack of knowledge regarding the behaviour of the material in the caved area or gob. The successful development of a load cell for measuring and/or recording the build up of load in longwall wastes would provide strata mechanics researchers with a tool for monitoring load transfer from the solid to the caved material and subsequent load build up during recompaction.

A research contract was let to design and develop a load cell suitable for measuring load in longwall wastes. The objectives of the contract can be summarized as follows:

i) review available technology for rugged load cell construction and monitoring through caved material that could find application in underground mines.

ii) consider the strengths and weaknesses of the various technologies

iii) rank the various technologies in order of their suitability for use in underground coal mines.

iv) design one or more load cells and monitoring systems that could be used in an underground coal mine for the purposes stated above, taking into account the following:

- cost
- portability

- ruggedness
- self-containment (i.e. intrinsically safe internal power supply if required)
- environmental operating ranges (i.e. waterproof, shock-resistant)
- suitable for certification for use in underground coal mines
- possibility of data logging arrangements
- reliability

the following design criteria should be incorporated:

- range of 0-70 MPa $\pm$ 10%
- insensitive to point loading
- suitable for installation and use in a longwall coalface

v) following written acceptance from the Scientific Authority, construct five (5) prototypes and deliver to the Scientific Authority for field testing.

Completion of the contract is expected by March 1985.

Ultrasonic Closure Meter

An ultrasonic closure meter developed by the USBM, (12), has been loaned to CBCRL from the Coal Mining Research Centre in Alberta. Modifications have been implimented so that it complies with the Canadian intrinsic safety requirements and upon notification of the certification number from CEAL in Ottawa an underground test programme will be initiated.

At Prince Mine it is proposed to measure rates of closure in the gateroads in the face vicinity as well as lateral extrusion of the coal seam during mining. At Lingan Mine it is intended to use the device for gateroad deformation surveys and the measurement of closure rates in the packhole.

STRATA MECHANICS RESEARCH - MINOR PROGRAMS

During 1984, five minor research projects, programmes or areas of interest have been addressed:

1) Geotechnical Data Base
2) Geostatistics
3) Calibration of Existing Instrumentation
4) Minewater Data Base
5) Chemical Stabilization of Coal Measures Strata

GEOTECHNICAL DATA BASE

Current CBCRL research programmes have resulted in a need for rock strength data for various strata types encountered in the Sydney Coalfield. Since CBCRL's rock testing facilities are not yet fully operational, a programme of irregular sample point load testing has been initiated to establish a preliminary geotechnical data base. Uniaxial compressive and tensile strength values have been derived from point load index tests conducted on coal samples obtained from four mine sites in the Sydney Coalfield, namely Lingan, No. 26, Prince and the NOVACO Point Aconi site. Strength values have been calculated both parallel and perpendicular to the bedding plane and an anisotropy index calculated, (13).

A similar programme of irregular sample point load testing has also been carried out on coal from the No. 1 (Scott Pit) Seam, Drummond Mine, Westville, N.S., (14).

GEOSTATISTICS

In 1983, work was undertaken to assess whether geostatistical techniques could be applied to the problems and conditions existing within the Sydney Coalfield, (15).

During 1984, although no inhouse work has been undertaken by CBCRL, the Technical University of Nova Scotia (TUNS) has obtained the CANMET Mine Evaluation Group G.E.M. (Geostatistical Evaluation of Mines) suite of programmes. A external graduate student is currently undertaking a detailed analysis of the NOVACO Point Aconi data and the progress of this work is being monitored by CBCRL.

CALIBRATION OF EXISTING INSTRUMENTATION

In March 1984, a series of calibration trials were undertaken on the Solinst load cells currently being used by CBCRL. A full description and discussion of these trials along with presentation of the results can be found elsewhere, (16).

Extensive use of the Irad Gage Sonic Probe Extensometer at the Donkin-Morien site in conjunction with the rock/support interaction study has necessitated its regular calibration in order to check that use in the rugged and often hostile underground environment has not affected its accuracy.

MINEWATER DATA BASE

Hydrochemical sampling of the Donkin-Morien fresh water well was ceased by CBCRL in March 1984, although intermittent monitoring has been continued by CBDC.

To date, all the available hydrochemical and inflow data concerning the No. 2 and No. 3 tunnels as well as the fresh water well at Donkin-Morien has been collected and it is expected that a report will be produced during the first half of 1985.

In-house CBCRL activities have been restricted to the development of data handling facilities. A computer programme has been written which enables data to be processed and subsequently plotted for the construction of Durov diagrams, (11).

CHEMICAL STABILIZATION OF COAL MEASURES STRATA

The strength and stability of underground coal measures strata is known to be affected by the absorption of water from various sources such as the mine atmosphere, dust suppression sprays and inflows of groundwater. One of the most frequent affects associated with water absorption is the reduction in strength due to the presence of swelling clays in the mine shales. The oil industry has long used chemicals to stabilize shale formations and the treatment methods are well established. A research contract (17) was let to undertake a preliminary review of the problem, examine the range of oil industry chemicals available and propose a laboratory test programme to evaluate the practicality and efficiency of the most promising chemicals for use in underground coal mines.

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